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Naturally occurring hexavalent chromium in tap water of Ahmedabad city: Health perspective with respect to Public Health Goal

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Abstract

Background information: Drinking water contamination with hexavalent chromium (Cr6+) either by natural or anthropogenic sources is an emerging global health problem. This issue got much impetus when Public Health Goal (PHG) proposed a maximum contamination limit (MCL) as low as 0.02 µg/l for Cr6+ against the current MCL for total chromium (50 µg/l, WHO). At present, Cr 6+ is an unregulated chemical; therefore, its monitoring and regulation deserve special attention. Materials and Methods: Ahmadabad city is the sixth largest city of India with a population more than 6.3 million. A general survey covering all the specified zones of Ahmedabad was carried out to examine naturally occurring Cr6+ in drinking water, obtained from Ahmedabad Municipal Corporation (AMC) and personal bore water supply. A total number of 415 drinking water samples (AMC, N=125: personal bore water, N=290) were analyzed for Cr6+ by ion chromatography employing US EPA method 218.6.

Results: A wide variation in the level of Cr6+ in drinking water was observed in bore water samples. The average value of Cr6+ was registered to be 14.57 µg/l (range 0.0 - 322.64 µg/l) with a median value of 6.39 µg/l. Cr6+ was not detected in about 19% of the bore well water samples (detection limit 0.3 ppb). On the contrary, AMC water supply had a considerably lower level of Cr 6+ (average 3.58µg/l, range 0.0 – 13.78 µg/l, median 2.58 µg/l) and it was not detected in 39.5% of the water samples. Seven bore water samples exceeded the maximum prescribed limit of WHO (50 µg/l). Relatively higher levels of Cr6+ in water samples were detected in the south and east zones of the city associated with industrial area as compared to non-industrial area.

Discussion: Data obtained in the present study are several hundreds to thousands-fold high than the suggested PHG (0.02µg/l) level of Cr 6+ as MCL. As the regulation of Cr6+ in drinking water is lacking at present, there have been great uncertainties of the risk assessment due to Cr6+ exposure. The general population ingesting Cr6+-contaminated drinking water might be at risk for developing chromium-induced health effects.

Conclusion: Cr6+ and its compounds are known carcinogens and need tight regulation. Data produced in this study might be useful for establishing revised MCL for Cr6+, which is lacking at present.

Keywords: Hexavalent chromium, $Cr6^{+}$, PHG, ionchromatography, drinking water.

Biography

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